



***FACTORS INFLUENCING DEVELOPMENT OF DAIRY CATTLE FARMING
IN MALAYSIA***

HAMED FAGHIRI

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**FACTORS INFLUENCING DEVELOPMENT OF DAIRY CATTLE FARMING
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By

HAMED FAGHIRI

**Thesis Submitted to the School of Graduate Studies, Universiti
Putra Malaysia, in Fulfilment of the Requirements for the Degree of
Doctor of Philosophy**

April 2019

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in
fulfilment of the requirement for the degree of Doctor of Philosophy

FACTORS INFLUENCING DEVELOPMENT OF DAIRY CATTLE FARMING IN MALAYSIA

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April 2019

Chair : Prof. Zulkornain B Yusop, PhD
Faculty : Economics and Management

The Malaysian dairy cattle industry does not produce enough quantity of dairy products to satisfy domestic market needs. As a result, Malaysia is one of the highest milk importing countries in the world. The objectives of the thesis are to identify the competitiveness of the factors influencing the dairy cattle industry, investigate and focus into the most important factors affecting the dairy cattle industry development, and determine the most appropriate dairy farm model in terms of initial investment and herd size for the nation. The population of this study covers Peninsular Malaysia's dairy cattle industry. The exploratory mix method is applied to initially identify the competitiveness level of factors and later to focus on the most important factors affecting the industry development in Malaysia.

The qualitative approach is used to identify the competitiveness of the factors influencing the dairy cattle industry. The sample of twelve participants were interviewed and the data are collected from semi-structured open-ended interviews. This study integrates the theory-driven and data-driven codes using Nvivo 10 software. The results show that most of the factors have low competitiveness level and the issues have spread to all aspects of the industry such as factor condition; related and supporting industries; company's structure; rivalry and organization; government's role; accessibility; and costs. There are only a few factors such as demand, natural resources (water), infrastructure (utilities and logistics) have a high and moderate level of competitiveness. Therefore, the contributions of many relevant stakeholders are very vital for any future improvement and development of this industry.

The quantitative is implemented to investigate and focus on the most important factors affecting the dairy cattle industry in Malaysia. In this part, an original research instrument has been developed. The Content Validity Index (CVI) method is applied in the pretesting and the reliability test (Cronbach's alpha technique) is used in the pilot test. The Structural Equation Modelling (SEM) is implemented to analyze the data by using the Smart-PLS 3 software. The findings demonstrate that the factors such as adequate land allocation for dairy farming and animal feed plantation, climate condition, logistic costs, animal feed price and accessibility, poor cow breed, lack of well trained and experienced labors, lack of knowledge on dairy farming, government policies, and the inappropriate environment of the industry are among the most important factors affecting Malaysian dairy cattle industry growth. The results of this part provide a roadmap for the dairy cattle industry stakeholders for their future development plan.

Finally, Cost and Benefit Analysis (CBA) is applied on 4 different dairy cattle farms with 100, 250, 500 and 1,000 milking dairy cows' capacity and 8, 20, 40 and 80 ha animal feed ranching. The outcomes show that the most ideal farm size is at least 1,000 heads milking dairy cows for Malaysia because it generates lower average costs and more income. However, bigger size farms need higher investment. Our study indicates that the most viable farm size is 500 cows because it is feasible and efficient enough at a lower investment rate. Additionally, farm with 250 cows is advisable just for the start with the aim to expand in the future. Finally, farms with smaller herds of less than 250 cows are not recommended because of the low income and high risk.

In conclusion, this study identified the competitiveness and level of importance of the factors affecting dairy cattle industry in Malaysia besides the most viable dairy farm size for Malaysia. These findings provide benefits to many dairy cattle industry stakeholders such as farmers, policymakers and researchers. Farmers can use these results to improve their current farm situation or in their future farm design. This information acts as a comprehensive roadmap for the policymakers for their future dairy cattle development plan. Finally, determining the appropriate solution for each of the explored critical factors in this industry can be a topic for future research.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

FAKTOR-FAKTOR PENENTU BAGI PEMBANGUNAN TERNAKAN LEMBU TENUSU DI MALAYSIA

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Industri lembu tenusu Malaysia tidak menghasilkan jumlah produk tenusu yang cukup untuk memenuhi keperluan pasaran domestik. Akibatnya, Malaysia adalah salah satu negara pengimport susu tertinggi di dunia. Objektif tesis ini adalah untuk mengenal pasti daya saing faktor-faktor yang mempengaruhi industri lembu tenusu, menyiasat dan menumpukan kepada faktor-faktor yang paling penting yang mempengaruhi pembangunan industri lembu tenusu dan menentukan model ladang tenusu yang paling sesuai dari segi pelaburan awal dan saiz ternakan untuk negara. Populasi kajian ini meliputi industri lembu tenusu Semenanjung Malaysia. Kaedah campuran penerokaan digunakan untuk mengenalpasti tahap daya saing faktor awal dan kemudian memberi tumpuan kepada faktor-faktor yang paling penting yang mempengaruhi pembangunan industri di Malaysia.

Kaedah kualitatif digunakan untuk mengenal pasti daya saing faktor-faktor yang mempengaruhi industri lembu tenusu. Satu sampel dua belas peserta telah ditemuramah dan data dikumpulkan daripada wawancara terbuka separuh berstruktur. Kajian ini mengintegrasikan kod yang berasaskan teori dan data menggunakan perisian Nvivo 10. Keputusan menunjukkan bahawa kebanyakan faktor mempunyai tahap daya saing rendah dan isu-isu merangkumi semua aspek industri seperti kondisi faktor; industri berkaitan dan sokongan; struktur syarikat; persaingan dan organisasi; peranan kerajaan; kebolehaksesan; dan kos. Terdapat hanya beberapa faktor seperti permintaan, sumber asli (air), infrastruktur (utiliti dan logistik) yang mempunyai tahap daya saing yang tinggi dan sederhana. Oleh itu, sumbangan pihak berkepentingan yang berkaitan adalah sangat penting untuk sebarang penambahbaikan dan perkembangan masa depan industri ini.

Kaedah kuantitatif dilaksanakan untuk menyiasat dan memberi tumpuan kepada faktor-faktor yang paling penting yang mempengaruhi industri lembu tenusu di Malaysia. Dalam bahagian ini, satu instrumen penyelidikan telah dibangunkan. Kaedah Pengesahan Kandungan (CVI) digunakan dalam "pretesting" dan ujian kebolehpercayaan (teknik alpha Cronbach) digunakan dalam ujian perintis. Pemodelan Persamaan Struktur (SEM) dilaksanakan untuk menganalisis data dengan menggunakan perisian Smart-PLS 3. Penemuan menunjukkan bahawa faktor-faktor seperti peruntukan tanah yang mencukupi untuk perladangan tenusu dan pemakanan haiwan, keadaan iklim, kos logistik, harga dan akses makanan haiwan, baka lembu yang lemah, kekurangan tenaga kerja yang terlatih dan berpengalaman, kurang pengetahuan mengenai pertanian tenusu, dasar kerajaan, dan persekitaran industri yang tidak sesuai adalah antara faktor terpenting yang mempengaruhi pertumbuhan industri lembu tenusu Malaysia. Hasil dari bahagian ini memberikan gambaran umum plan tindakan yang penting untuk industri tenusu bagi merancang pembangunan masa depan industri tersebut.

Akhirnya, Analisis Kos dan Manfaat (CBA) diterapkan ke 4 ladang lembu tenusu yang berbeza dengan kapasiti 100, 250, 500 dan 1,000 susu lembu susu dan 8, 20, 40 dan 80 hektar penternakan haiwan. Hasilnya menunjukkan bahawa saiz ladang yang paling ideal adalah sekurang-kurangnya 1,000 ekor lembu tenusu untuk Malaysia kerana ia menjana kos purata yang lebih rendah di samping pendapatan yang lebih baik. Walau bagaimanapun, ladang saiz lebih besar memerlukan pelaburan yang lebih tinggi. Kajian kami menunjukkan bahawa saiz ladang yang paling berdaya maju adalah 500 ekor lembu kerana ia boleh dilaksanakan dengan cekap pada kadar pelaburan yang lebih rendah. Di samping itu, ladang dengan 250 ekor lembu adalah dicadangkan hanya untuk permulaan dengan matlamat untuk berkembang pada masa akan datang. Akhirnya, ladang dengan kumpulan lebih kecil kurang daripada 250 ekor adalah tidak disyorkan kerana pendapatan yang rendah dan risiko yang tinggi.

Kesimpulannya, kajian ini mengenal pasti tahap daya saing dan kepentingan faktor-faktor yang mempengaruhi industri lembu tenusu di Malaysia di samping saiz ladang tenusu yang paling ideal untuk Malaysia. Penemuan ini memberi banyak faedah untuk semua pemegang taruh industri lembu tenusu seperti petani, pembuat dasar dan penyelidik. Para petani boleh menggunakan keputusan ini untuk memperbaiki keadaan ladang semasa mereka atau dalam reka bentuk ladang masa depan mereka. Maklumat ini bertindak sebagai pelan yang komprehensif untuk pembuat dasar untuk pelan pembangunan lembu tenusu masa depan mereka. Akhirnya, mencari penyelesaian yang tepat bagi setiap faktor kritikal yang diterokai dalam industri ini adalah merupakan antara topik penyelidikan yang dicadangkan pada masa akan datang.

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I certify that a Thesis Examination Committee has met on 2 April 2019 to conduct the final examination of Hamed Faghiri on his thesis entitled "Factors Influencing Development of Dairy Cattle Farming in Malaysia" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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LIST OF ABBREVIATIONS

AI	Artificial Insemination
ARI	Average Return of Investment
ARR	Accounting Rate of Return
Ave	Average
AVE	Average Variance Extracted
BCG	Boston Consulting Group
BCR	Benefit and Cost Ratio
CBA	Cost and Benefit Analysis
CB-SEM	Covariance Based Structural Equation Modeling
CFA	Confirmatory Factor Analysis
CFT	Cool Farm Tool
CMV	Common Method Variance
CO ₂	Carbon Dioxide
CR	Composite Reliability
CTA	Confirmatory Tetrad Analysis
CVI	Content Validity Index
DEDJTR	Department of Economic Development, Jobs, Transport and Resources
DEFRA	Department for Environment, Food & Rural Affairs
DEPIV	Department of Environment & Primary Industries Victoria
DFA	Dairy Farmers of America
DI	Dairy Cattle Industry
DIY	Do It Yourself
DMI	Dry Matter Intake
DVS	Department of Veterinary Services
EFA	Exploratory Factor Analysis
EPP	Entry Point Projects
ETP	Economic Transformation Program
EU	Europe
FA	Factor Analysis
FAO	Food and Agriculture Organization
FB	Feed and Breed
FIMIX	Finite Mixture
G	Government
GHG	Greenhouse Gas
ha	Hectare
HCMs	Hierarchical component models
HOC	Higher-Order Component
HR	Human Resource
HTMT	Heterotrait Monotrait
I-CVI	Item Content Validity Index
IE	Industry Environment
INPVP	Incremental Net Present Values
IRR	Internal Rate of Return
JAKIM	Malaysian Islamic authority
Kg	Kilogram

Km	Kilometer
KMO	Kaiser-Meyer-Olkin
KN	Knowledge
K-R20	Kuder-Richardson formulas 20
L	Litre
LCL	Land, Climate, and Logistic
LID	Local Indian Dairy
LOCs	Lower-Order Components
M	Mean
MCC	Milk Collection Centres
MGA	Multi Group Analysis
MICOM	Measurement Invariance of Composite Models
mil	Million
MOA	Ministry of Agriculture
n	Number
NAP	National Agricultural Policy
NDDP	National Dairy Development Program
NFS	Non-Fat-Solid
NIBM	National Institutes of Biotechnology Malaysia
NKEA	National Key Economic Areas
NPV	Net Present Value
NPVwp	Net Present Value of conducting a project
NPWwop	Net Present Value of not conducting a project
OLS	Ordinary Least Squares
PAF	Principal Axis Factoring
PCA	Principal Components Analysis
PLS	Partial Least Squares
PLSc	Partial Least Square consistent
PLS-SEM	Partial Least Squares Structural Equation Modelling
POS	Prediction Oriented Segmentation
PPIT	Government-run Dairy cattle industry Service Centers
PV	Present Value
QDA	Qualitative Data Analysis
RD&E	Research, Development, Extension
RM	Ringgit Malaysia
ROI	Return On Investment
S-CVI	Scale-level Content Validity Index
SD	Standard Deviation
SEM	Structure Equation Modelling
SSL	Self Sufficiency Level
TEV	Total Economic Value
UAE	United Arab Emirates
UK	United Kingdom
USA	United State of America
USD	United State Dollar
VIF	Variance Inflation Factor
WEF	World Economic Forum
WTA	Willingness To Accept
WTP	Willingness To Pay

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The global milk and dairy products production and the market are estimated to increase 2.2 percent from 2017 and reach 843 million tons at the year-end 2018. Asia (India, Turkey, and Pakistan), the European Union, the United States of America (USA) and Argentina are growing the production of the milk and dairy products; in contrast, China and Ukraine are at a decreasing trend. This milk output growth has come about as a result of increasing the number of the dairy cattle, improving milk collection process, implementing the high efficiency integrated dairy production systems, enhanced the productivity per cow, increased usage of idle capacity and higher market demand. The production drops mostly because of applying the industrial restructuring policies in China and reducing the dairy products profit margin in Ukraine (FAO, 2019, March). Table 1.1 shows the world dairy market at a glance.

Table 1.1: The world dairy market at a glance (Million-ton, milk equivalent)

Year	2016	2017	2018	2017/2016 (%)
World total milk production	821.8	824.8	842.9	2.2
World total trade	70.7	72.9	75	2.9

Source: FAO report, (2019, March; 2017, November)

In the global milk and dairy product markets, Malaysia is one of the greatest milk importer countries after China, Mexico, Algeria, Russian Federation, Indonesia, Saudi Arabia, and Philippines (FAO, 2019, March). Figure 1.1 shows the major importing of milk and dairy product countries in the world.

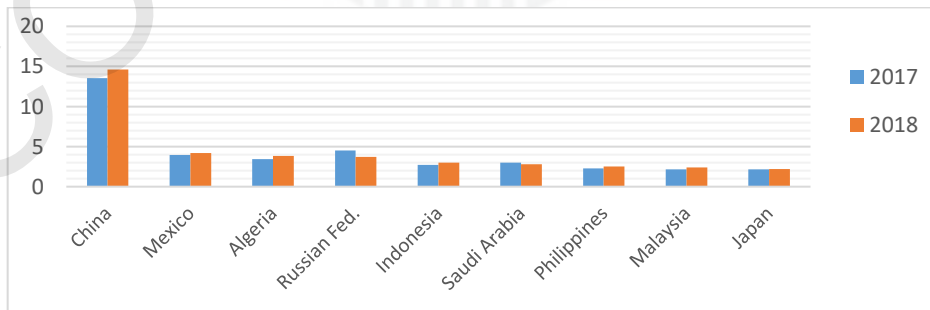


Figure 1.1: The milk and milk products importing countries (Million-ton, milk equivalent)

Source: FAO report, (2019, March).

Based on the above figure Malaysian imports of milk in the last two years from 2017 to 2018 remained the same. This is due to the inability of the Malaysian dairy cattle industry to fulfil the domestic market needs and demand. The Malaysian dairy cattle industry did not grow and develop rapidly in line with the increasing market demand for dairy products during the current decade due to the population growth, higher income, and urbanization (Dong, 2006). Additionally, statistics from the Department of Veterinary Services (DVS) show that milk production in Malaysia increased slowly. For example, the annual growth rate of milk production was only 3.26% in the year 2017. Table 1.2 shows the annual growth rate of milk production in Malaysia from 2012-2017 (DVS, 2018).

Table 1.2: Annual growth rate of the milk product in Malaysia

Year	2012	2013	2014	2015	2016	2017
Total (Million L)	27.0	28.8	34.1	36.5	36.7	37.9
Growth rate (%)	7%	6.66%	18.40%	7.04%	0.55%	3.26%

Source: DVS (2018).

According to Table 1.2 information, the speed of milk production growth has decreased from 18.40% in the year 2014 to 3.26% in the year 2017. Possible reasons for this conclusion relates to the fact that the Malaysian dairy cattle industry has faced many challenges such as i) the lack of skills and training, ii) low breed performance and iii) inadaptability to local environmental conditions, poor dairy farm management, and inadequate nutritious feed, and iv) high input and feed costs (Sim & Suntharalingam, 2015).

The Malaysian government has supported dairy cattle farming for around five decades. They have planned and tried many economic development strategies and policies to improve the local dairy cattle industry, however, this industry is still undeveloped. This occurs because it has faced many unresolved complex challenges and issues (Sim & Suntharalingam, 2015).

1.2 The challenges and issues of the dairy cattle industry in Malaysia

Historically, the dairy cattle industry has not been the tradition of the local Malaysians. However, Indians immigrant started a small dairy cattle industry in early of the 20th century. The farms were concentrated nearby the rubber and oil palm plantation and the borders of the urban areas. In recent decades, the government of Malaysia has attempted to develop this industry especially those owned by the private sectors but the industry still remains small with average low production (Sim & Suntharalingam, 2015). There are several challenges and the issues that the Malaysian dairy industry has faced during the past decades.

Malaysia has to import milk and dairy products to satisfy its domestic market demand. In fact, the import value of the dairy products increased from less than RM 100 million in the year 1970 to more than RM 1 billion in the year 2017. Although the level of milk production has improved slowly over the past 40 years, Malaysia is still unable to fulfil the domestic market dairy demand (Boniface & Umberger, 2012; DVS, 2018).

Moreover, the increasing public awareness of the nutritional benefits of fluid milk consumption coupled with a preference towards other dairy products has gained the demand for both milk and dairy-derived products in Malaysia. The domestic demands for milk and dairy products are increasing continuously. Therefore, the government of Malaysia tried to formulate policies to provide support to overcome this market need (Sim & Suntharalingam, 2015).

One of the important factors related to the dairy cattle industry is SSL. Most of the countries import dairy products with only a few countries achieving 100% self-sufficient for these products such as India, Iran, Pakistan, and Turkey in Asia. A large majority of countries have dairy productions less than their market needs and demands (FAO, 2016, June). However, only a few countries have less than 25% SSL of dairy products and milk that included Malaysia, Philippines, the Democratic Republic of the Congo, Côte d'Ivoire, Gabon, Gambia, Ghana, Jamaica, and Papua New Guinea. For example, the milk production Self Sufficiency Level (SSL) for Malaysia was only 3.04% in the year 2016 (FAO, 2016, June; DVS, 2018).

In order to increase SSL, the domestic production of milk should be increased. Therefore, the Malaysian government decided to develop the dairy cattle industry and to increase the SSL of the country under the Third National Agricultural Policy (NAP3, 1999) from 1998-2010. They also have the same aim for the period of 2011-2020 in the fourth National National Agro-food Policy (NAP, 2011).

Furthermore, the problem is not limited to the low level of raw milk production only. Figure 1.2 illustrates the food balance sheet of different dairy products in Malaysia except for milk such as butter, cheese, skim milk powder, whole milk powder, and whey powder. It highlights that food balance sheet for dairy products have been negative since 2010. If we look closely at figure 1.2, the amount of dairy products imports has increased over the years. Therefore, the consumption level of the dairy products has increased over the years while the related and supporting dairy industries are not developed enough to cover the local demand and Malaysia still rely on importing different types of the dairy products. Perhaps, Malaysian need to pay special attention to the related and supporting dairy as well as food industries to produce more different types of dairy products domestically and improve the food balance sheet for these products.

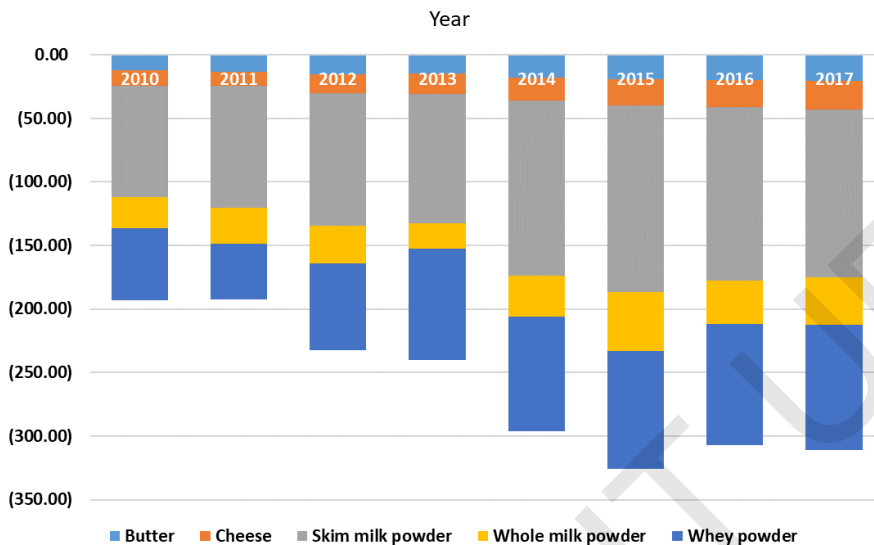


Figure 1.2: The Food balance sheet of different dairy products in Malaysia (Thousand Ton)

Source: OECD (2018)

Moreover, the Malaysian government has formulated several new programs to develop further the dairy cattle farming industry. The Economic Transformation Program (ETP, 2015) proposed an Entry Point Projects (EPP) within the Agriculture National Key Economic Areas (NKEA): “EPP13: Establishing dairy clusters in Malaysia by collaborating with the large foreign dairy companies. This project aims to develop the local dairy cattle industry and increase SSL of dairy products. Additionally, it can improve the local market perception of the domestic dairy division and guarantee a stable demand and market” (NKEA, 2016). Indeed, the aim of these proposals is to integrate smallholder farmers into some large clustered scale. Therefore, the large scale of the agri-business supposed to perform higher value-added dairy products. The newly established anchor companies should adopt better technology, know-how, and knowledge to increase the level of production.

According to the Economic Transformation Program Annual Report (ETP, 2015), 281 farmers are under EPP13 of which 198 of them are considered smallholders because they only have less than 30 dairy cattle on their farm. The encouraging progress has shown in the report but still, the main challenge and problem is the competition between the prices of the local fresh milk and the imported milk that has a lower price than local milk.

Furthermore, the success of dairy farming is directly related to milk production costs and market price. The dairy farm operation depends on many different factors such as costs of production, market supply, and demand (Jayaweera, et al., 2007; Benni, Finger, & Mann, 2012). In fact, the stability of farm profits is

effectively influenced by off-farm revenue, direct costs, size, location, and liquidity.

Additionally, the investment in this industry is still considered very risky because of several factors such as lack of skills and training, Low breed performance and inadaptability to local environmental conditions, Poor dairy farm management and inadequate nutritious feed, High input and feed costs (Suntharalingam, Sithambaram, Graff, & Saari, 2015b; Panandam & Raymond, 2005; Jeyabalan, 2010; Sim & Suntharalingam, 2015; Suntharalingam, et al., 2015c; Suntharalingam & Ahmad, 2015a). Therefore, all of the mentioned factors should consider future plans to reduce the level of investment risk and increase the production level.

1.3 Problem statement

As mentioned, the Malaysian government has applied many plans for the development of the dairy cattle industry in Malaysia for around five decades. In fact, the government has tried many economic development strategies and corridors to improve the domestic dairy cattle industry and overcome all expected problems and weaknesses for decades, however, the dairy cattle industry still remains undeveloped. This occurs because the industry has faced many unresolved complex challenges and issues such as the lack of skills and training, low breed performance and inadaptability to local environmental conditions, poor dairy farm management, inadequate nutritious feed, high input and feed costs for decades. Additionally, there are many factors which do not list or the importance of them is still unclear. Thus, the government, farmers and the rest of the industry stakeholders should know all factors influencing the dairy industry and the importance of them before any further movement. This information will support them to draw the more practical roadmap, set the realistic targets and provide a comprehensive development plan.

Therefore, it is necessary first to explore all factors influencing the dairy cattle industry in general. Then, it is very essential to investigate and highlight the most important factors affecting the dairy cattle industry in Malaysia. The finding of this part provided a roadmap for the government and farmers so as to improve the level of the milk production, SSL, and the overall dairy cattle industry in Malaysia.

Additionally, the success of dairy farming is directly related to milk production costs and market price. The dairy farm operation depends on many different factors such as costs of production, market supply, and demand. Further, the stability of farm profits is effectively influenced by off-farm revenue, direct costs, size, location, and liquidity. For the healthy growth of the Malaysian dairy cattle industry, both the Malaysian government and farmers need the feasible, viable, and profitable dairy cattle farm model plans that could deliver the efficient milk production and income over the years. This plan should be able to provide the

lowest cost of production, optimum farm size, ideal location, and technology utilization for better implementation of the EPP13. Finally, these project plans should cover not only financial elements but also economic and technical parts as well as environmental concerns and requirements.

1.4 Objectives of the study

Given the above problem statements, three objectives have been identified namely:

- i- To identify the competitiveness of the factors influencing the dairy cattle industry in Malaysia.
- ii- To investigate and focus on the most important factors affecting the dairy cattle industry development in Malaysia.
- iii- To determine the most appropriate and feasible dairy farm model (capacity and herd size) for Malaysia.

1.5 Significance of the study

The current dairy cattle industry in Malaysia is in an unhealthy condition and Malaysia imports a substantial amount of the different dairy products every year (Sim & Suntharalingam, 2015). Therefore, the main purpose of this study is to guide the farmers, government agencies, financial institutions, and the rest of the players in the dairy cattle industry to develop the level of the dairy production in Malaysia.

The first essay explored the overall factors influencing the dairy cattle industry development and the second essay focused on determining the most important factors affecting the dairy cattle industry in Malaysia. It is conjectured that the challenges are not only limited technically to dairy farms (Warr, Rodriguez, & Penm, 2008). The inadequacy of many other players involved in related and supporting industries of the domestic market demand are also constraining the healthy growth of the dairy cattle industry in Malaysia (Boniface, Gyau, Stringer, & Umberger, 2010). Certainly, the government has a significant role to play. This research is intended to focus on factors contributing to the various aspects of the dairy cattle industry in Malaysia.

Having a firm understanding of the forces influencing the state of development of the industry would provide a clear perspective on how to raise the milk and dairy products industry, as well as improve the Malaysian SSL. With knowledge of the relevant and important change forces, the proper technical, financial and economic elements of dairy cattle farm model plans could be properly framed.

In the third essay, various models of dairy cattle farming (capacity and herd size) were identified and their technical, financial and economic feasibilities analyzed. This effort can contribute towards the Malaysian government's proposals for the future development of the industry (EEP13). In fact, any large scale and modern farming projects need a high initial capital and investment, which investors, bank, and other financing organizations, are not willing to partake without a proper feasibility study with clear financial and economic consideration and analysis. The third essay of this study has an objective to investigate the most ideal and suitable dairy farm size for Malaysian which could convince the governments, farmers, investors, financial institutions, and organizations to invest in it.

1.6 Organization of the study

The present thesis is intended to investigate the business and economic factors affecting the dairy cattle industry in Malaysia and in trying to identify the appropriate dairy cattle industry model that have incorporated technical business and economic considerations to address the problems and constraints enveloping the industry in Malaysia. Chapter one has presented an introduction describing the current situation of the Malaysian dairy cattle industry and highlighting the importance of the milk production industry and SSL in the country. The Malaysian dairy cattle industry challenges and problems have been discussed in the statement of the problem followed by the objectives of the study and its significance followed by the importance of coming up with a technical and financially feasible dairy farm-scale in Malaysia. The following chapter two represents the dairy cattle industry in Malaysia. The literature relevant to the study is discussed in chapter three.

Chapter four illustrates the methods adopted in the study involving the mix method approaches of Porters' Diamond model, Structural Equation Modeling (SEM) and Cost and Benefit Analysis (CBA). Moreover, it covers the sampling procedure, the analytical framework, data collection and the rest of the information related to the methodology of the study. The fifth chapter provides the findings of research on objective one that identifying the competitiveness of the factors influencing the dairy cattle industry in Malaysia and the sixth chapter provides the findings of objective two that narrows down and focuses on the most important factors affecting the dairy cattle industry development in Malaysia. Chapter Seven discusses the findings on s the most appropriate dairy farm model (capacity and herd size) for Malaysia and chapter eight contains the summary, conclusion, limitation of the study and recommendations for the future research.

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